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DECUS NO.	8-545
TITLE	PIF (Program Interrupt Facility for 3 TTY's)
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SOURCE LANGUAGE	PAL III



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DECUS Program Library Write-up

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STARTING THE PROGRAM

In order to start this program, set the switch register to 0200 and press Load Address. Then press Clear and Continue. You will see a rapidly counting AC. The TTY's are now ready for use. This program was originally devised to make it easier to type up a paper tape by putting in a Control/Tab and an automatic CR/LF.

As a demonstration program it can be used to show the speed of a computer by giving the illusion that it is doing many things all at once.

PROGRAM DESCRIPTION

PIF (Program Interrupt Facility for 3 TTY's) is a versatile Utility or Demonstration program. As it is presently set up the program is split up into five major parts.

1. The Background Program - This program is just a counting program that increments the AC after a delay of 4095 counts of a storage space. This is only used as a demonstration; this portion of the program may be changed to perform just about any function under an interrupt system.

2. The Identification Routine - This routine is the first routine entered after an interrupt is encountered. By a series of skip-on-flag instructions it is determined what device is calling for the interrupt. Once this has been ascertained, control is then put over to the control routines. (Note: If there is an interrupt called for by a device not specified in the Identification routine the program will halt with 0423 in the Program Counter.)

3. Control Routine - This is the main body of the interrupt system and is itself broken into two parts.

A. Input - This part first reads and shows the character input by the given TTY, stores the character and then clears the keyboard flag, therefore disabling any further interrupts from that TTY until another character is typed on the keyboard. I then jump to a check subroutine (explained later) and return to the routine with three options:

1) If "HOLD" is 0 then the character was no special one and we return to the background program.

2) If "HOLD" is 1 then it is a Control/Tab and a counter is set up for the tabulation. Control is then returned to the background program.

3) If "HOLD" is -1 then it is a CR/LF and a switch is set up for the line feed and then control is returned to the background program.

B. Output - When this routine is entered the teleprinter flag is cleared therefore disabling further interrupt from that device. Then there are again three choices:

1) If the counter that has been set up is 0 nothing is to be output, therefore control is returned to the background program.

2) If the counter is positive we have a Control/Tab and we must print out a space, check if it has been eight spaces and then return to the background program. If eight spaces have printed the counter is set to zero.

3) If the counter is negative it is a CR/LF and a Linefeed must be given, the counter cleared and control returned to the background program.

4. Check Routine - This routine checks for each type of character and returns to the input routine with three options:

1) If a normal character "HOLD" is set to 0.

2) If a Control/Tab "HOLD" is set to 1.

3) If a CR/LF "HOLD" is set to -1.

5. Program Interchange - This is located on the zero page and is a transfer routine. There are two stages of the interchange:

A. Interrupt Call Phase - When an interrupt is given, there is a JMS 0 operated by the computer and the PC. is automatically saved. Immediately the interrupt is turned off, the AC is saved and if desired the link can be saved. Control is then passed to the Identification routine.

B. Return Phase - The AC (link if desired) is returned to normal, interrupt turned on and control returned to the background program by a JMP I 0.

Different Devices for Input and Output - In the system that I have made for this program I use three ASR-33 TTY's. The device codes on them were Console, 40 and 42. Therefore all of my input-output instructions for the printers had to be defined to assemble the program in PAL III. At the end of the program listing is a list of defined input-output instructions for printing, reading, skip-on-flag and clear flag instructions. If it is desired to change either the device coding or the device altogether all you need to do is change the defined codes. To clarify how they are used I shall explain further.

TLS2=6416 means print a character on TTY number two with a device code for output of 41

KRB3=6426 means read a character on TTY number three with a device code for input of 42

The same follows for all other input-output instructions for all devices and their corresponding input-output codings.

Location of Different Routines

1. Background Program= 200-207
2. Identification Routine= 400-422
3. Control Routine-

Input-TTY1= 422-463
TTY2= 507-530
TTY3= 554-575

Output-TTY1= 464-506
TTY2= 531-553
TTY3= 600-622

4. Check Routine= 423-441
5. Program Interchange-

Interrupt Call Phase= 0.5
Return Phase= 20-22

Possible Program Modifications

1. Save Link Modification

		*0000
0000	0000	ACCESS, 0
0001	6002	IOF
0002	3007	DCA AC
0003	7004	RAL
0004	3010	DCA LINK
0005	5406	JMP I SERVE
0006	0400	SERVE, USE
0007	0000	AC,0
0010	0000	LINK,0
		*0020
0020	1010	RESTAR, TAD LINK
0021	7110	CLL RAR
0022	1007	TAD AC
0023	6001	ION
0024	5400	JMP I ACCESS

2. If a change in the background program is desired the whole routine may be changed from locations 0202 on up. But a word of caution must be given here. In the background program any input-output requested while the interrupt is on will cause a JMS 0.

The contents in 0200 and 0201 must remain the same and the program must be started at the same location always.

		*0	
00000	00000		ACCESS,0
00001	60002	IOF	
00002	30005	DCA AC	
00003	54004	JMP I SERVE	
00004	04000	SERVE,USE	
00005	00000	AC,0	
		*00020	
00020	10005	RESTAR,TAD AC	
00021	60001	ION	
00022	54000	JMP I ACCESS	
		*02000	
02000	60007	CAF	
02001	60001	ION	
02002	73000	CLA CLL	
02003	22007	ISZ WAIT	
02004	52003	JMP .-1	
02005	70001	IAC	
02006	52003	JMP .-3	
02007	00000	WAIT,0	
		*04000	
04000	64001	USE,KSF2	
04001	74100	SKP	
04002	53007	JMP TTY2	
04003	6411	TSF2	
04004	74100	SKP	
04005	5331	JMP_TTY20	
04006	6421	KSF3	
04007	74100	SKP	
04100	5354	JMP TTY3I	
04111	6431	TSF3	
04112	74100	SKP	
04113	5776	JMP I TZY	
04114	6031	KSF	
04115	74100	SKP	
04116	5242	JMP TTY1I	
04117	6041	TSF	
04200	74100	SKP	
0421	5264	JMP TTY10	
0422	74002	HLT	
0423	00000	CHECK,0	
0424	1055	TAD HOLD	
0425	1053	TAD MBACK	
0426	7640	SZA CLA	
0427	5233	JMP .+4	
0430	7040	CMA	
0431	3055	DCA HOLD	
0432	5623	JMP I CHECK	
0433	1055	TAD HOLD	
0434	1054	TAD CTRLTB	
0435	7640	SZA CLA	
0436	5240	JMP .+2	

0437	7001	IAC
0440	3055	DCA HOLD
0441	5623	JMP I CHECK
0442	6036	TTY11, KRB
0443	6046	TLS
0444	3055	DCA HOLD
0445	6032	KCC
0446	4223	JMS CHECK
0447	1055	TAD HOLD
0450	7450	SNA
0451	5020	JMP RESTAR
0452	7710	SPA CLA
0453	5262	JMP .+7
0454	1050	TAD SPACES
0455	3061	DCA COUNT1
0456	7001	IAC
0457	3056	DCA HOLD1
0460	7000	NOP
0461	5020	JMP RESTAR
0462	1055	TAD HOLD
0463	5257	JMP .-4
0464	6042	TTY10, TCF
0465	1056	TAD HOLD1
0466	7450	SNA
0467	5020	JMP RESTAR
0470	7710	SPA CLA
0471	5302	JMP .+11
0472	1051	TAD SPACE
0473	6046	TLS
0474	7200	CLA
0475	2061	ISZ COUNT1
0476	5020	JMP RESTAR
0477	5304	JMP .+5
0500	6042	TCF
0501	5276	JMP .-3
0502	1052	TAD LF
0503	6046	TLS
0504	7200	CLA
0505	3056	DCA HOLD1
0506	5300	JMP .-6
0507	6406	TTY2, KRB2
0510	6416	TLS2
0511	3055	DCA HOLD
0512	6402	KCC2
0513	4223	JMS CHECK
0514	1055	TAD HOLD
0515	7450	SNA
0516	5020	JMP RESTAR
0517	7710	SPA CLA
0520	5327	JMP .+7
0521	1050	TAD SPACES
0522	3062	DCA COUNT2
0523	7001	IAC
0524	3057	DCA HOLD2
0525	7000	NOP
0526	5020	JMP RESTAR

0527	1055	TAD HOLD
0530	5324	JMP .-4
0531	6412	TTY20,TCF2
0532	1057	TAD HOLD2
0533	7450	SNA
0534	5020	JMP RESTAR
0535	7710	SPA CLA
0536	5347	JMP .+11
0537	1051	TAD SPACE
0540	6416	TLS2
0541	7200	CLA
0542	2062	ISZ COUNT2
0543	5020	JMP RESTAR
0544	5351	JMP .+5
0545	6412	TCF2
0546	5343	JMP .-3
0547	1052	TAD LF
0550	6416	TLS2
0551	7200	CLA
0552	3057	DCA HOLD2
0553	5345	JMP .-6
0554	6426	TTY31,KRB3
0555	6436	TLS3
0556	3055	DCA HOLD
0557	6422	KCC3
0560	4223	JMS CHECK
0561	1055	TAD HOLD
0562	7450	SNA
0563	5020	JMP RESTAR
0564	7710	SPA CLA
0565	5374	JMP .+7
0566	1050	TAD SPACES
0576	3063	DCA COUNT3
0570	7001	IAC
0571	3060	DCA HOLD3
0572	7000	NOP
0573	5020	JMP RESTAR
0574	1055	TAD HOLD
0575	5371	JMP .-4
0576	0600	TZY,TTY30
		*0600
0600	6432	TTY30,TCF3
0601	1060	TAD HOLD3
0602	7450	SNA
0603	5020	JMP RESTAR
0604	7710	SPA CLA
0605	5216	JMP .+11
0606	1051	TAD SPACE
0607	6436	TLS3
0610	7200	CLA
0611	2063	ISZ COUNT3
0612	5020	JMP RESTAR
0613	5220	JMP .+5
0614	6432	TCF3
0615	5212	JMP .-3

0616	1052	TAD LF
0617	6436	TLS3
0620	7200	CLA
0621	3060	DCA HOLD 3
0622	5214	JMP .-6
		*0050
0050	7770	SPACE8,-8
0051	0240	SPACE,240
0052	0212	LF,212
0053	7563	MBACK,-215
0054	7567	CTRLTB,-211
0055	0000	HOLD,0
0056	0000	HOLD1,0
0057	0000	HOLD2,0
0060	0000	HOLD3,0
0061	0000	COUNT1,0
0062	0000	COUNT2,0
0063	0000	COUNT3,0
		TSF2=6411
		TSF3=6431
		KSF2=6401
		KSF3=6421
		TLS2=6416
		TLS3=6436
		KRB2=6406
		KRB3=6426
		CAF=6007
		SPF=6040
		SPF2=6410
		SPF3=6430
		TCF2=6412
		TCF3=6432
		KCC2=6402
		KCC3=6422

AC	0005
ACCESS	0000
CAF	6007
CHECK	0423
COUNT1	0061
COUNT2	0062
COUNT3	0063
CTRLTB	0054
HOLD	0055
HOLD1	0056
HOLD2	0057
HOLD3	0060
KCC2	6402
KCC3	6422
KRB2	6406
KRB3	6426
KSF2	6401
KSF3	6421
LF	0052
MBACK	0053

RESTAR	0020
SERVE	0004
SPACE	0051
SPACE8	0050
SPF	6040
SPF2	6410
SPF3	6430
TCF2	6412
TCF3	6432
TLS2	6416
TLS3	6436
TSF2	6411
TSF3	6431
TTY1I	0442
TTY10	0464
TTY2	0507
TTY20	0531
TTY31	0554
TTY30	0600
TZY	0576
USE	0400
WAIT	0207

